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(54) METHOD FOR PRECOOLING IN PRESERVATION AND TRANSPORTATION OF FRUIT AND VEGETABLE

(57)Abstract:

PURPOSE: To preserve freshness of fruit and vegetable for a long period of time and to precool fruit and vegetable by sealing fruits and vegetables in a plastic bag, cooling approximately to the freezing point of fruit and vegetable, chilling close to a supercooling break temperature and gradually raising temperature approximately to room temperature.

CONSTITUTION: Fruits and vegetables (e.g. spinach) are sealed in a plastic bag such as polyethylene having 20-100μ thickness, cooled (primary cooling) to a temperature 1 to 2°C higher than the freezing point of fruit and vegetable in 1-12 hours, chilled at -5°C/1 hour to -0.5°C /24 hour to just higher supercooling break temperature (secondary cooling), allowed to stand as it is for 30 minutes to 1 year, heated (primary heating) up to 0°C, warmed (secondary heating) up to 5°C and finally heated (final heating) up to 10-20°C so that cooling and heating treatment are mildly carried out by stages, amounts of respiration and metabolism are maintained low to give storable and transportable fruits and vegetables having freshness for a long period of time.

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the pre-cooling method that freshness can be held for a long period of time, as neither vegetables nor fruits deteriorate during storage / transportation of fresh fruits and vegetables.
[0002]
[Description of the Prior Art]Conventionally, in pre-cooling by the preservation of fruits and vegetables, although there is differential pressure pre-cooling, vacuum pre-cooling, hydro-cooling, or forced-draft pre-cooling, All were pre-cooling at the low temperature over 0 **, and since breathing and a metabolic turnover were not controlled enough, there was a possibility that softening of fruits and vegetables, fading, and putrefaction might arise, for the stress accompanying the rise of a rapid temperature produced in transportation.
[0003]
[Problem(s) to be Solved by the Invention]Rather than the temperature in the conventional method of pre-cooling conventional storage and transportation of fruits and vegetables, cool at low temperature 0 ** or less gradually, and this invention ranks second to it, By carrying out temperature-up processing gradually, the knowledge of carrying out prolonged freshness keeping of fruits or the vegetables was carried out rather than having been based on the conventional pre-cooling method, and this invention was attained.
[0004]
[Means for Solving the Problem]Put fruits or vegetables into a 20-100-micrometer-thick plastic bag, and they are sealed, After carrying out cooling (the first cooling) processing over 1 minute - 12 hours from a freezing point of fruits and the vegetables concerned to a temperature high 1-2 **, at the rate of -0.5 **/1h--0.5 **/24 h, It cools to temperature of 0.5-5 ** this side rather than the supercooling breaking point (the second cooling), After neglecting it for 0.5h- one year

then, using 0 ** in 2 to 10 hours and carrying out temperature up subsequently to 5 ** in 2 to 10 hours, it is the pre-cooling method in storage and transportation of fruits and vegetables carrying out temperature up to 10-20 **.

[0005]That a plastic bag used by this invention meant a bag made from a film of a polyethylene system or a vinyl chloride system, and thickness of a film was 20-100 micrometers, It is because carbon dioxide levels in a bag become high and the thickness starts tenebrescence during pre-cooling processing by breathing by which it is slightly carried out by breathability becoming low, if there is a possibility that moisture permeability may be high and fruits and vegetables may be frozen in less than 20 micrometers and it exceeds 100 micrometers. Using plastic film bag manufacture can also ease a cooling rate of internal fruits and vegetables.

[0006]Although it is for preventing a fall of the freshness, without freezing fruits and vegetables, cooling fruits or vegetables of brass tic packing in this invention from 1 minute over 12 hours from a freezing point of the fruits concerned or vegetables to a temperature high 1-2 ** (the first cooling), Having made cooling temperature high with 1-2 ** from a freezing point in this cooling process, It is because an error of machine accuracy was 0.5-1 **, and processing time was made into 1 minute - 24 hours because cooling unevenness was produced, and in less than 1 minute, if it exceeds 12 hours, it is because freshness falls during cooling.

[0007]When freezing point temperature of fruits and vegetables is illustrated, next, asparagus 0.6**, They are string bean 0.7**, sweet corn 1.8**, spinach 0.8**, curie 0.5**, ginseng 14**, 1.3-1.7 ** of grapes, orange 1.3--3.1 **, banana 1.7--2.3 **, apple 1.9--3.2 **, and ****-9**.

[0008]Carrying out the cooling process (the second cooling) of fruits and the vegetables cooled by the above-mentioned first cooling process by a temperature higher 1-2 ** than a freezing point of fruits and the vegetable concerned to a front temperature rather than the supercooling breaking point, Being because there being possibility of freezing when the supercooling breaking point is approached, and having set a cooling rate to -0.5 **/1h--0.5 **/24 h, It is because it is for making freezing resistance give fruits and vegetables to which breathing and a metabolic turnover were reduced roughly, the speed is the metabolic turnover which freezing starts easily in speed over -0.5/1 h, and is performed during a cooling process in speed below -0.5/24h and degradation of quality arises in the first cooling process. As for a front temperature, it is preferred to consider it as 0.5-5 ** this side.

[0009]Next, when temperature of the supercooling breaking point is illustrated, they are ****-1.0--0.6 **, duplex century ****- 3.5--4.5 **, sweet corn 2--5.0 **, spinach 1.2--5.0 **, asparagus 2.5--3.0 **, and ginseng 1.5--6.0 **.

[0010]Neglecting fruits or vegetables which were cooled to a front temperature rather than supercooling destructive temperature for [0.5 hour -] one year, Are because all the cells of these fruits or vegetables are fully cooled and a living body's mechanism changes to a state in which little metabolic turnover also has possible life support, and in less than 30 minutes. It is

because there is little metabolic turnover depressor effect, and a possibility of it being neglected under a front temperature for a long period of time, causing a living body's aging, and being unable to bear low temperature, but causing freezing and freezing death from supercooling destructive temperature will become high if a possibility that respiration rate will increase rapidly becomes high and exceeds one year in temperature-up processing by a next process.

[0011]Enzyme activity is increased most automatically, without carrying out temperature's up (the first temperature's up) to 0 ** softening, in order that a metabolic turnover of fruits and vegetables may begin to work slowly, and fading fruits or vegetables which neglected it at temperature before the above-mentioned supercooling breaking point, and were held at low temperature in 2 to 10 hours.

[0012]After carrying out temperature-up processing up to 0 **, an increase in metabolic can take place smoothly and carrying out temperature-up processing (the second temperature up) to 5 ** can make quality hold highly, without giving stress to fruits and vegetables by carrying out temperature up gradually.

[0013]Since it circulates at 10-20 ** in a final marketing stage of fruits and vegetables, it is usually for quality maintenance in a circulation temperature zone to make fruits and vegetables by which temperature-up processing was carried out gradually reach a 10-20 ** temperature zone repeatedly.

[0014]

[Work example 1]By 20-micrometer-thick polyethylene bag manufacture, pack a spinach (freezing point-0.8 ** and supercooling breaking point-1.5--5 **), and in 10 minutes, From ordinary temperature, to 0 ** at -0.5 **/a rate of 12 hours after cooling (the first cooling). -After dropping temperature (the second cooling) and neglecting it as it is to 1 ** for 0.5 hour, Since 0 ** (first the warming) is used in 2 hours and temperature up was carried out subsequently to 5 ** (second the warming) in 8 hours, a spinach by this example which carried out temperature up, which was obtained to 10 ** (last warming) and which carried out pre-cooling processing held a freshness degree for ten days.

[0015]At the process cooled from ordinary temperature to 0 ** in [in the method of the above-mentioned example] 10 minutes (the first cooling). It cooled to 10 **, and the cooling process was carried out to the temperature of 0 ** or more at the process cooled to -1 ** in -0.5 **/12 hours (the second cooling), and, as for the spinach obtained by carrying out temperature-up processing at a stretch to 10 ** in 2 hours, tenebrescence was seen in four to six days.

[0016]

[Work example 2]Put a sweet corn (freezing point-1.8 ** and supercooling breaking point-2-5 **) into 70-micrometer-thick polyethylene bag manufacture, seal it, and in 4 hours. After cooling from ordinary temperature to -1 **, the temperature is made to lower to -2.5 ** by -5 **/one h,

After neglecting it for 20 days then, and, carrying out 5 ** temperature up subsequently to 0 ** in 10 hours in 5 hours, the sweet corn by this example which carried out temperature up, which was obtained to 20 ** and by which pre-cooling processing was carried out held the tension and sugar content of the fresh grain for ten days.

[0017]In the same method as an example, when temperature up was carried out at a stretch to 20 ** in 5 hours, without carrying out temperature-up processing gradually, the sugar content fell rapidly.

[0018]

[Work example 3]After putting a peach (freezing point-0.9 ** and supercooling breaking point-1--6 **) into polyethylene bag manufacture of thickness mum, sealing it and cooling to 0 ** in 12 hours, at a rate of -0.5 **/24 h. -After using 0 ** in 10 hours after dropping temperature and neglecting it for three days as it is to 1.5 ** and carrying out temperature up subsequently to 5 ** in 2 hours, the obtained peach fruits by this example which carried out 20 ** temperature up and by which pre-cooling processing was carried out held fresh tone and hardness for 30 days.

[0019]In the same method as the above, without carrying out temperature-up processing gradually, when temperature up was carried out at a stretch to 20 ** in 8 hours, softening was seen in seven days.

[0020]

[Work example 4]Put a ginseng (freezing point-1.4 ** and supercooling destructive temperature-1.5--6.0 **) into 60-micrometer-thick POREECHIREN bag manufacture, and it is sealed, Since it carries out to 0 ** in 20 hours and temperature up was subsequently carried out to 10 ** in 30 hours after cooling to 0 ** in 1 minute, dropping temperature and neglecting it as it is to -2.0 ** at a rate of -0.5 **/24 h for one year, the obtained ginseng which carried out 20 ** temperature up held the fresh color for 100 days.

[0021]In the method of the above-mentioned example, fading and browning were observed for the cooling process by 1 time up to 5 ** of a case in 2 minutes on the 30th.

[0022]

[Effect of the Invention]In this invention, cooling and temperature-up processing are performed slowly gradually.

Therefore, after temperature up makes breathing and the metabolic amount of fruit vegetables hold low, and might make freshness hold for a long period of time.

[Translation done.]

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(54)【発明の名称】　果実・野菜の貯蔵や輸送における予冷方法

(57)【要約】
【目的】　生鮮な果実・野菜を長期間鮮度を保持した状態で、貯蔵や輸送をするための予冷方法。
【構成】　果実・野菜を、当該果実・野菜の氷結点よりも１～２℃高い温度まで１分～１２時間で冷却した後、－０．５℃／１時間～－０．５℃／２４時間の速度で過冷却最低点よりも手前の温度まで冷却し、そのまま０．５時間～１年間放置した後、０℃までに昇温させ、次いで５℃までに昇温させた後、１０～２０℃まで昇温させる果実または野菜の貯蔵や輸送における予冷方法。

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【特許請求の範囲】

【請求項1】　果実・野菜を、厚さ20～100μmのプラスチック製袋に密封して、1～12時間で、当該果実・野菜の氷結点よりも1～2℃高い温度まで冷却した後、－0．5℃／1時間～－0．5℃／24時間の速度で、過冷却破壊温度の手前の温度まで冷却し、そのまま30分～1年間放置してから、0℃まで昇温させ、次いで、5℃まで昇温させた後、10～20℃まで昇温させることを特徴とする果実・野菜の貯蔵や輸送における予冷方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、生鮮な果実や野菜の貯蔵・輸送中に、野菜や果実が変質しないようにして、長期間鮮度を保持することができる予冷方法に関する。

【0002】

【従来技術】従来果実・野菜の貯蔵法での予冷において、差圧予冷、真空予冷、ハイドロクーリングまたは強制通風予冷などがあるが、何れも0℃を超えた低温での予冷であり、呼吸、代謝が充分抑制されていないため、輸送で生じる急激な温度の上昇に伴うストレスで、果実・野菜の軟化、退色、腐敗が生じる恐れがあった。

【0003】

【発明が解決しようとする課題】本発明は、従来の果実・野菜の貯蔵や輸送での、従来の予冷法における温度よりも0℃以下の低温に、段階的に冷却し、次いで、段階的に昇温処理をすることにより、従来の予冷法によるよりも、果実や野菜を長期間鮮度保持させることを知見して、本発明を達成したのである。

【0004】

【課題を解決するための手段】果実または野菜を、厚さ20～100μmのプラスチック製袋に入れ、密封して、1分～12時間かけて、当該果実・野菜の氷結点から1～2℃高い温度まで冷却（第1次冷却）処理した後、－0．5℃／1h～－0．5℃／24hの速度で、過冷却破壊点よりも0．5～5℃手前の温度まで冷却（第2次冷却）して、そのまま0．5h～1年間放置してから、2～10時間で0℃に、次いで2～10時間で5℃に昇温させた後、10～20℃まで昇温させることを特徴とする果実・野菜の貯蔵や輸送における予冷方法である。

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【0005】

【作用】本発明は、果実・野菜を凍結させる温度を緩和することもできるのである。

【0006】本発明での、プラスチックたは野菜を、1分から12時間かけて、野菜の氷結点から1～2℃高い温度まで冷却）するのは、果実・野菜を凍結させる鮮度の低下を防止するためであるが、こたり、冷却温度を、氷結点から1～2℃は、機械精度の誤差を0．5～1℃とし、また処理時間を、1分～24時間としたでは、冷却むらを生じるからであり、1は、冷却中に鮮度が低下するからである。

【0007】次に、果実・野菜の氷結点と、アスパラガス－0．6℃、サヤインゲ℃、スイートコーン－1．8℃、ホウレ℃、キュウリ－0．5℃、エンジン－1．3～1．7℃、オレンジ－1．3～ナナ－1．7～－2．3℃、リンゴ－1．℃、モモ－9℃である。

【0008】上記の第1次冷却処理で、の氷結点よりも1～2℃高い温度までに野菜を、過冷却破壊点よりも手前の温度〈第2次冷却〉するのは、過冷却破壊点結の可能性があるからであり、また冷却5℃／1h～－0．5℃／24hとした却処理で、呼吸、代謝を大まかに低下さに耐凍性を付与させるためであり、その5／1hを超えた速さでは、凍結が絶ま5／24h未満の速さでは、冷却処理中代謝で、品質の劣化が生じるからである。度は、0．5～5℃手前とするのが好ま

【0009】次に、過冷却破壊点の温度モモ－1．0～－0．6℃、二重咲ネ4．5℃、スイートコーン－2～－5．ソウ－1．2～－5．0℃、アスパラガ3．0℃、エンジン－1．5～－6．0

【0010】過冷却破壊温度よりも手前した果実または野菜を0．5時間～1年は、該果実または野菜の全ての細胞が完て、少ない代謝でも生命維持が可能な状ニズムが発生するからであり、30分未

【００１２】０℃までの昇温処理した後，更に５℃まで昇温処理（第２次昇温）するのは，段階的に昇温させることにより，果実・野菜に，ストレスを与えることなく，代謝の増加がスムーズに起こり，品質を高度に保持させることができるのである。

【００１３】繰り返して，段階的に昇温処理された果実・野菜を，１０～２０℃の温度帯に到達させるのは，通常，果実・野菜の末端流通段階では１０～２０℃で流通されるので，流通温度帯での品質保持のためである。

【００１４】

【実施例１】氷結点－０．８℃，過冷却破壊点－１．５～－５℃のホウレンソウを厚さ２０μmのポリエチレン製袋で包装して，１０分間で，常温から０℃まで冷却（第１次冷却）後，－０．５℃／１２時間の割合で，－１℃まで温度を降下（第２次冷却）させて，そのまま０．５時間放置した後，２時間で０℃（第１次加温）に，次いで８時間で５℃（第２次加温）に昇温させてから，１０℃（最終加温）まで昇温させて得た，本実施例による予冷処理したホウレンソウは１０日間新鮮度を保持した。

【００１５】上記実施例の方法での，１０分間で常温から０℃まで冷却（第一次冷却）する工程で，１０℃まで冷却し，また－０．５℃／１２時間で，－１℃まで冷却（第２次冷却）する工程で，０℃以上の温度に冷却処理し，２時間で１０℃まで一気に昇温処理して得たホウレンソウは４～６日間で褪色がみられた。

【００１６】

【実施例２】氷結点－１．８℃，過冷却破壊点－２～－５℃のスイートコーンを厚さ７０μmのポリエチレン製袋に入れて密封し，４時間で，常温から－１℃まで冷却してから，－５℃／１ｈで，－２．５℃まで降温させ，そのまま２０日間放置してから，５時間で０℃に，次いで１０時間で５℃昇温させた後，２０℃まで昇温させて得た．本実施例による予冷処理されたスイ１０日間新鮮な粒の張りと糖度を保持し

【００１７】実施例と同様な方法におい温処理せずに５時間で２０℃まで一気に糖度が急激に低下した。

【００１８】

【実施例３】氷結点－０．９℃，過冷却６℃のモモを厚さμmのポリエチレン製し，１２時間で０℃まで冷却してから，４ｈの割合で，－１．５℃まで温度を降ま３日間放置した後，１０時間で０℃に，で５℃に昇温させた後，２０℃昇温させ例による予冷処理されたモモ果実は３０色合いと硬さを保持していた。

【００１９】上記と同様な方法において，処理せずに，８時間で２０℃まで一気に７日間で軟化がみられた。

【００２０】

【実施例４】氷結点－１．４℃，過冷却５～－６．０℃のニンジンを，厚さ６０レン製袋に入れて密封して，１分で０℃ら，－０．５℃／２４ｈの割合で－２．降下させて，そのまま１年放置した後，まで，次いで３０時間で１０℃まで昇温０℃昇温させて得たニンジンは１００日色を保持していた。

【００２１】上記実施例の方法において，２分で５℃までの１回のみの場合では，変が観察された。

【００２２】

【発明の効果】本発明によれば，段階的・昇温処理を行うので，昇温後も果菜類を低く保持させ，鮮度を長期間保持させ